Competitive & Complementary

Harmless water

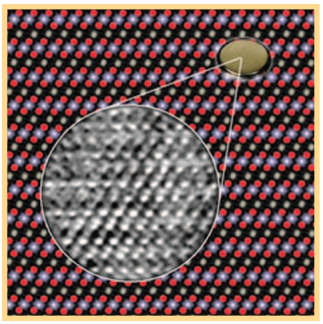
Photolithography resists are surprisingly unaffected by contact with water. Early pattern imaging at IBM on wafers immersed in water "worked much better than we thought," said Bill Hinsberg, a research staff member. Hinsberg said IBM immersed wafers coated with normal chemically-amplified photoresist in water for up to a minute. Wafers were removed, dried, and exposed with a normal 193nm scanner. The resulting patterns show little degradation compared with resists not exposed to water. The resists tested did absorb some water, but this does not seem to have a major impact on performance. In the late '90s, IBM research showed in tests that immersion lithography could provide dramatic improvements in resolution. Using tools and resists for 0.25µ lithography, the IBM team showed that immersion could produce 45µ lines & spaces. Progress at MIT's Lincoln Lab, the Rochester Institute of Technology and other research centers have prompted speculation that 193nm lithography with immersion could be used for the 32µ node by the end of the decade.

Cadence buys Verplex

Cadence Design Systems Inc will acquire Verplex Systems Inc, whose formal verification software will be integrated with Cadence Incisive and Cadence Encounter platforms for IC design to enable efficient and independent verification for the industry's route to big, fast chips. Cadence also will continue to support Verplex products in alternative flows. "A roadmap for incorporation of Verplex's products is currently under development," says Cadence GM, Penny Herscher.

OÅM catches lithium atom

Researchers have used a One Angstrom transmission electron microscope to image lithium atoms. Only atoms of hydrogen and helium are smaller and lighter than those of lithium, which under ordinary conditions is not a gas but a soft, white metal. Yang Shao-Horn of the Department of Mechanical Engineering at the MIT and Michael O'Keefe of Berkeley Lab's Materials Sciences division used the OÅM to simultaneously resolve columns of lithium, cobalt, and oxygen atoms in the compound lithium cobalt oxide ($LiCoO_2$). The structure of $LiCoO_2$ is known theoretically and has been confirmed with x-ray diffraction and neutron powder diffraction: layers of lithium atoms lie between slabs of cobalt and oxygen, which are arranged in octahedrons. Experimental imaging of the lithium ions and vacancies proved difficult in this study," says Shao-Horn. "Nevertheless, the atomic resolution of lithium atoms is a novel and significant achievement, with implications for better understanding not only of lithium ion battery materials but of many other electroceramic materials as well."



$LiCoO_2$: A simulation program shows how the arrangement of lithium ions (tan) among cobalt (blue) and oxygen (red) atoms in lithium cobalt oxide ought to appear. The closely matching experimental image obtained with the OÅM is inset in black and white.

Frequency doubling for near UV range

Although many materials are capable of generating laser light, few operate at the shorter wavelengths. Scientists from the Fraunhofer Institute have a laser that produces wavelengths of down to 370µ, near UV range, achieved by a frequency-doubling technique. Andreas Hofmann leads the IPM's laser imaging research group, which has managed to achieve a selective effect by applying electric fields to crystals of lithium niobate. Using an IPM-patented drive system, they have been able to achieve several milliwatts for the first time. Frequency doubling offers the advantage of allowing commercial laser diodes to be used as the pumping device. These emit in the visible to near IR region, at wavelengths between 740µ and 1,100µ. At an output power of 100 milliwatts, the beams are of sufficiently high quality to enable the short-wavelength main laser to be used in imaging, analysis and diagnosis instruments. The beam can be directed and modulated by deliberately modifying the molecular structure of the lithium niobate crystal. Metal electrodes are placed on the two surfaces of the crystal slice. When an electric field is applied, the crystal axis between the two electrodes switches permanently to the opposite sense. Domain inversion produces lasing areas of a defined geometry within the crystal and is a prerequisite to volume processing of such crystal wafers.

3D metamaterials

Joint work on lead selenide (a semiconductor with applications in infrared detectors and thermal imaging and that can be tuned to be more sensitive to specific infrared wavelengths) and magnetic iron oxide (best known for its use in the coatings for certain magnetic recording media) has allowed IBM to announce new 3D designer metamaterials.

According to the Columbia and New Orleans University scientists who designed the new metamaterials, 2D patterns have previously been created from gold nanoparticles of different sizes and mixtures of gold and silver.
Extending this to 3D with more diverse types of materials gives the ability to bring more materials together than previously recognised. The combination of these nanoparticles may have novel magneto-optical properties as well as properties key to the realisation of quantum computing.

Harris R&D

Harris Corp in communications technology has approved a R&D agreement with the University of Florida's College of Engineering, facilitating collaboration between Harris and the university in a variety of engineering fields. Kwame Boakye, Harris VP of technology says "We have synergy in a number of research areas, including advanced communications, nanotechnology, mechanical systems, power systems, database and information processing."